Diploma Programme
Programme du diplôme
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Markscheme

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Information technology in a global society

Standard level

Paper 1

15 pages

1. A cashless society

Note to examiners:
- *All part (a) questions are marked using ticks and annotations where appropriate.*
- *Part (b) and part (c) are marked using markbands. Use annotations and text comments to provide a rationale behind the marks you awarded.* ***Do not use ticks.***

(a) When a user wants to make a payment with the *Swish* app, the app will need to collect data about the transaction.

(i) Identify **two** items of data that the app could collect from the user making the payment. **[2]**

Answers may include:
- the name of the person making the payment / username / ID Number (accept other personal identifiers)
- password
- phone number of the person making the payment
- bank account to be used for the transaction (in the case that there is more than one account linked to the Swish app)
- amount of the transaction/cost of the item
- message (to indicate what the transaction was for) / personal greeting card.
- name of person receiving the payment
- Swish account details / phone number of the person receiving the payment.

Note: Do not accept data that are system generated, e.g., date/time of transaction, transaction id, etc.

Award ***[1]*** *for identifying each item of data that the app would collect from the user making the payment up to maximum of* ***[2]*** *marks.*

(ii) Identify the steps taken by the app to make the payment into the bank account of the person receiving the money. **[4]**

Answers may include:
- user is verified
- buyer ’s / payer’s bank account is accessed (by the app)
- authorization from the bank for the amount required – amount of the transaction is compared to the amount of money/credit available in the buyer’s bank account
- authorization from the bank for the amount required – amount of the transaction is compared to the limit the bank permits for Swish transactions
- determine the seller’s / payee’s bank in order to initiate a transfer
- if authorized, then transfer of money from buyer’s bank to seller’s bank
- if not authorized, then error message (to buyer and seller)
- message sent (to buyer and seller) to confirm transaction.

Award ***[1]*** *for identifying each step taken by the app to complete the transaction up to maximum of* ***[4]*** *marks.*

(b) Explain why it is important that any data sharing agreement between the *Swish* app and the Swedish banks has policies that address both the storing **and** sharing of app users' data. **[6]**

Answers may include:
Storing:

- to ensure that data is protected by a strong security network (firewalls, anti-malware protection, encryption etc)
- to provide strong security for any machines that have access to the data
- to ensure that access to data is restricted to people who have a need to know
- to provide protections against loss of data are in place
- to provide protections against any attacks aimed at stealing or changing the data
- to provide a plan for backup and recovery.
- to make sure that only relevant data is stored
- to prevent data being stored after people have left the Swish platform.
- to make sure that data being stored adheres to data protection laws as governed in specific locations, e.g., data stored in Sweden follows GDPR

Sharing:

- to ensure that data is only shared with the consent of the app users
- to ensure that any data shared should be anonymized as far as possible to prevent the identity of the app user being determined
- to ensure that app users should be informed if there are any additional organizations that their data may be shared with and for what purpose
- to ensure that data will be shared using secure means.

*Award **[1]** for a reason why it is important that any data sharing agreement between the Swish app and the Swedish banks has policies that address the processing/sharing of app users' data and **[2]** for developments of that reason up to maximum of **[3]** marks.*

*Mark as **[3]** + **[3]***

(c) Many people in Sweden have seen the advantages of using the *Swish* app. It allows friends to share a restaurant bill, to pay where credit or debit cards are not accepted, to easily pay for babysitting or parking tickets, or make a donation at church. However, some people in Sweden have expressed concerns about not using cash and making the *Swish* app the only means of payment.

To what extent do the advantages of the *Swish* app as the only means of payment outweigh the disadvantages. **[8]**

Answers may include:

Advantages of using *Swish*:

- no need to carry cash / credit cards – no risk of being stolen/no risk of not having enough cash
- no risk of credit card being used fraudulently
- transactions are recorded – there is proof of payment
- payments can be done immediately – no need to wait until person has time to go to bank to get cash
- can solve other problems regarding money – bills can be shared, one person pays and money is transferred
- in an emergency money can be transferred to dependents without them being close (eg children at university)
- allows money transactions between individuals
- transfers of money are in real time (instantly) and free of charge
- amount of money to be transferred is limited thus minimising the loss of money.
- many people are already used to the app so it would be a good choice if the country were going cashless.
- easier for users to track budgets / spending as all transactions are on one app.

Disadvantages of using *Swish*:

- Swedish banks will be able to obtain more data on their users' transaction habits (privacy concern)
- is not available to people who do not have a bank account so a potential digital divide concern
- it only works within Sweden, or people who have a Swedish bank account so may be problematic for tourists
- removes the anonymity of the payee in transactions – Swish stores a user's transaction history. This would include date, item, recipient of the money and cost of the item
- the bank controls the maximum amount of money that can be transferred – this may limit a person's spending
- the transition from a society that uses cash for transactions to one that does not may not be possible and in trying to make this transition it may cause considerable harm to many citizens.
- use of the Swish app (specifically) would give the company an unfair monopoly over the technology
- Digital Divide – smartphones ownership and use by mature adults
- if a person loses his/her phone or breaks it or its battery runs out, he/she has no way to pay for anything.
- failure in / lack of phone network coverage could affect when and where people could use the app.
- Failure of the system / technical issues / down time which would prevent people from making transactions.

Accept implicit and explicit references to the Swish app.

Please see generic markband information sheet on page 15.

2. Automatic crop watering system

(a) (i) Identify **three** characteristics of proprietary software. **[3]**

Answers may include:

- software is copyrighted
- commercial software
- relicensing, distribution or copying is prohibited
- the user/organization must accept the agreement prior to installing or using the software
- requires a subscription or monthly fee
- has customer support and maintenance of the software provided by its developers as part of the purchase of the software.

*Award **[1]** for identifying each characteristic of proprietary software up to maximum of **[3]** marks.*

(ii) A computer program uses the data provided by the rain sensor to decide whether to water the trees. Identify the steps in this program. **[3]**

Answers may include:

- the sensor gathers analog data
- the analog data is converted into digital data
- the computer compares the data to a preset level within the program to determine if it is raining.

Either:

- if it is raining the computer program will not start/will stop watering
- if it is not raining the watering continues as programmed.

Or:

- if the ground reaches a certain dampness then the watering is stopped
- if the ground has not reached a certain dampness then the watering continues as programmed.

*Award **[1]** for identifying each step the computer program will use when deciding whether to water the trees up to maximum of **[3]** marks.*

(b) Water is becoming increasingly scarce in Chacra Province and the provincial government is concerned there will be a point when there is not enough water for all of the farms to water their crops or fruit trees.

To manage water for the watering of crops and fruit trees, the provincial government of Chacra Province intends to create a computer model to calculate how much water each farm in the province will receive.

Explain **three** factors that will contribute to the accuracy of the model. **[6]**

Answers may include:

- quality of data input
- high quality data will allow for a more accurate model to be developed as this data will be more reliable / current water levels within each area must be accurate.

- frequency of readings taken
- more frequent readings may be able to pick up more subtle changes in the patterns of rainfall to increase the accuracy of the model / if we take daily readings and use these to create the model, that will be more accurate that monthly readings.

- number of variables taken into account when developing the model
- more variables will enable other, potentially less important, factors to be considered when developing the model / what crops are farmed in different areas in the province / the weather conditions in different areas of the province.

- number of assumptions that have been built into the model
- if any of the assumptions are weak or false the model will be inaccurate.

- quantity of data input
- if the sample of data is larger, then the resulting model would be more accurate / spans several years.

*Award **[1]** for identifying a factor that will contribute to the accuracy of the model and **[1]** for explanation why that will contribute to the accuracy of the model up to maximum of **[2]** marks.*

OR

*Award **[1]** for each example given and an additional **[1]** if the explanation contributes to the accuracy of the model up to a maximum of **[2]** marks.*

*Mark as **[2]** + **[2]** + **[2]***

Check with your team leader before accepting additional answers.

(c) The farmers of Chacra Province are concerned about the provincial government using a computer model to determine the amount of water they will be allowed to use to water their fruit trees.

To what extent should the farmers of Chacra Province rely on their knowledge and experience, rather than the computer-based solution provided by the provincial government, to manage the watering of the fruit trees? **[8]**

Answers may include:

Knowledge and experience will:

- allow the farmers to see more than water needs for a plant (sick leaves, buds falling, *etc*) without needing to develop a model
- be able to include other factors that may arise from time to time such as quality of the water (*eg* coming with mud) and adjust their watering accordingly
- be able to resolve potential issues that cannot be programmed into the computer, or would be outside of the scope of a computational solution
- provide expertise that cannot be quantified/ensure that in a worst-case scenario some of the farmers will be able to grow crops/trees.

Use of the provincial model will:

- allow water to be distributed evenly between the farmers on a “needs” basis rather than based on the opinions of one or two stronger characters
- a scientific approach has limits (e.g. there may be variables which the model does not take into account), the decisions around the water requirements of the trees may be based as much on intuition as algorithms and models.
- model may be biased or influenced by politics e.g. farmers may not have fully disclosed their data / government may favour certain groups or industries.

Use of the proprietary computer system will:

- reduce the amount of time farmers need to spend visibly checking their fields
- allow exact water usage to be measured and lead to potential efficiencies in its usage
- will provide quantitative data that could be used as a model for other farmers growing the same trees in similar locations.

Please see generic markband information sheet on page 15.

3. Technology disruption in Orams Academy

(a) (i) Identify **two** characteristics of cloud-based storage. **[2]**

Answers may include:

- data is stored on remote servers accessed from the internet, or "cloud"
- data can be accessed from anywhere as long as the person has an Internet connection
- online space allows users to store data, photos, music, and videos
- documents stored in the cloud can be shared with others (most of the time) instead of sending them via emails
- cloud storage providers may provide other services like backups
- requires a username and password for access.

*Award **[1]** for each characteristic of cloud-based storage identified up to **[2]** marks.*

(ii) Identify **two** reasons why there might be a lack of bandwidth at times on the school's network. **[2]**

Answers may include:

- many students are using the internet (e.g. for social media) at certain times of the day (e.g. lunchtimes)
- a large number of classes are working simultaneously on collaborative projects (ie Google docs)
- due to geographic location, local ISPs may not be able to offer enough bandwidth so that at certain times there isn't enough for all the users / shared bandwidth causes internet speeds to fluctuate
- technical issues at the ISP's end may cause slow internet bandwidth supply to its clients for periods of time
- large videos are being streamed or downloaded to show in classrooms
- network design or infrastructure is not optimal / outdated equipment causes frequent outages.

*Award **[1]** for each reason identified up to **[2]** marks.*

(iii) Identify **two** potential disadvantages of using online collaborative tools. **[2]**

Answers may include:

- information in the file could be modified and/or deleted by some of the collaborators by mistake
- internet is needed to view the most updated version of the documents and work / to share and collaborate
- different bandwidths/internet connection of the different users may make collaboration inefficient. / More difficult to communicate if a user has poor internet connection, decreasing productivity
- collaborative tools may not work optimally if the number of users gets too big.

*Award **[1]** for identifying each disadvantage of using online collaborative tools up to **[2]** marks.*

(b) An acceptable-use policy will be required for the appropriate use of virtual learning environments and collaborative online tools in Orams Academy.

Explain **three** elements that would be included in an acceptable-use policy for Orams Academy. **[6]**

Answers may include:

- a philosophy of Orams Academy relating to the use of online environments
- which acts as a guiding statement and provides the overarching principles for online behavior.

- a code of conduct
- that provides clear and unambiguous directions about how staff and students should act while online / using appropriate language in text chats / avoiding bullying behaviour / avoiding copying or plagiarism.

please check with team leader for other answers

- an outline of the sanctions
- that would be imposed if staff or students did not adhere to the code of conduct.

- a disclaimer
- so that Orams Academy is not responsible for the actions of the staff or students if an illegal activity is carried out / managers at Orams Academy are able to supervise everything that is posted onto the VLE / managers at Orams Academy would be able to read students' messages.

please check with team leader for other answers

- data privacy and protection
- so it will be transparent who owns the data created in VLE, for how long and what type of data is collected by the VLE servers.

*Award **[1]** for an element that would be included in an acceptable-use policy for Orams Academy and **[1]** for a development of that reason up to maximum of **[2]** marks.*

OR

*Award **[1]** for each example given and an additional **[1]** for a development of this example up to a maximum of **[2]** marks.*

*Mark as **[2]** + **[2]** + **[2]**.*

Check with your team leader before accepting additional examples.

(c) Discuss whether Daniela should make every teacher at Orams Academy use the same learning platform **or** she should allow each teacher to choose their own preferred learning management approach. **[8]**

Answers may include:

A single learning platform:

- means that all of the information is centralized and can be easily accessed by staff, students and parents
- the training requirements for staff are reduced as they only have to use one system
- prevents the use of a range of formats that may be incompatible meaning that resources cannot be shared, or may need adapting to work on a different platform
- having a common learning platform would make it convenient for the IT dept. to take backup/restore and roll-over data to new academic year.
- makes it easier for senior managers to monitor the actions of staff, to view lessons etc for consistency
- can be integrated into any acceptable-user policy or training requirements
- may be costly and based on proprietary software meaning that fixes could be expensive and take a long time to happen
- if the single platform is inaccessible for any reason, then all learning content would be inaccessible.

Teachers choosing their own preferred learning management approach:

- allows teachers to use their expertise of particular tools
- allows teachers to feel they are being allowed to use their creativity and innovative approach to the teaching and learning
- may integrate with social media tools that may be blocked by the school and provide a better user experience
- may provide better functionality than a “one size fits all” approach
- may lead to staff or students working outside of an acceptable-user policy/using the sites inappropriately
- the training requirements for staff will be increased if the staff are unfamiliar with the platforms / training will only occur on an ad hoc basis / training might be decreased since staff are already familiar with the tools they choose to use
- expertise of a platform may depend on particular teachers – if they leave then no one may be able to support students with this tool.

Please see generic markband information sheet on page 15.

4. Voice simulation

(a) (i) *Lyrebird* uses a person's voice-print to determine their identity.

Identify **two** other methods of biometric identification that could be used to determine a person's identity. **[2]**

Answers may include:
- fingerprints
- eye/retinal scans
- palm prints/hand geometry
- facial recognition.

*Award **[1]** for each method of biometric feature identified up to **[2]** marks.*

(ii) Identify **two** audio file formats that could be used to store the voice-print. **[2]**

Answers may include:
- MP3
- WAV
- WMA
- OGG
- AAC
- FLAC
- AVI.

*Award **[1]** for each audio file format identified up to **[2]** marks.*

(iii) The voice-print created can be compressed using lossless or lossy compression.

Describe the difference between lossless and lossy compression. **[2]**

Answers may include:
- lossless compression is when the original data can be recreated after compression/no quality is lost
- lossy compression is when some of the quality may be lost when the data is decompressed/the decompression is based on a best-fit algorithm by the compression software and may not perfectly recreate the original file.

*Award **[1]** for a correct identification of a difference between lossy and lossless compression and **[1]** for a further development up to **[2]** marks.*

(b) Analyse whether it would be appropriate for *Lyrebird* to release the biometric data of a user to a third party. **[6]**

Answers may include:
It would be appropriate:

- to law enforcement agencies for a warrant, subpoena, or court order
- in response to requests by regulatory, legal or government agencies as the information cannot be obtained by any other means
- by with-holding this information it would be working against the ethical principles of *Lyrebird*
- if it is necessary or appropriate to do so to protect our rights, property, or safety
- where the user has provided *Lyrebird* with written consent to disclosure of your biometric data.

It would not be appropriate:

- where the releasing of the data would lead to harm being caused to the person whose data is being released, for example, data that is linked to an underlying medical condition
- where it is in direct contradiction to the policies that *Lyrebird* have for the sharing of data
- as it could be harmful to the reputation of *Lyrebird*
- as it is an invasion of privacy to release personal data without consent
- it is illegal under the laws of the country in which Lyrebird operates (e.g. GDPR).

Marks	***Level descriptor***
0	*No knowledge or understanding of ITGS issues and concepts. No use of appropriate ITGS terminology.*
1–2	*A limited response that indicates very little understanding of the topic or the reason is not clear. Uses little or no appropriate ITGS terminology. No reference is made to the scenario in the stimulus material. The response is theoretical.*
3–4	*A description, unbalanced or partial analysis of the issues related to the release the biometric data of a user to a third party. There is some use of appropriate ITGS terminology in the response.*
5–6	*A balanced and detailed analysis of the relative advantages and disadvantages of the release the biometric data of a user to a third party. Explicit and relevant references are made to the scenario in the stimulus material. There is appropriate ITGS terminology throughout the response.*

(c) To what extent do the benefits of using *Lyrebird*'s voice cloning software outweigh the concerns that may arise from its use? **[8]**

Answers may include:
Benefits may include:

- could help people who have lost their voice
- could create better voice activated interfaces
- characters in video games could have individual voices, could clone your own voice as a playable character
- could provide interactive training and learning
- could be used in educational software to produce a more realistic experience
- any device that requires speech could be enhanced by more natural voices (appointment reminders, personal assistant applications, audiobooks, *etc*)
- parents could use the software to "read" to their children.

Concerns may include:

- could be used to create fake news or weaken the public's confidence in news of all kinds
- increase in robocalls with realistic voices – scammers will be able to deceive people more easily, or make fake calls to the police
- may lead to systems that use voice as a method of authentication become compromised as scammers are able to quickly create a user's voiceprint and access the system.

Please see generic markband information sheet on page 15.

SL and HL paper 1 part (c) and HL paper 3 question 3 markband

Marks	*Level descriptor*
No marks	• *A response with no knowledge or understanding of the relevant ITGS issues and concepts.* • *A response that includes no appropriate ITGS terminology.*
Basic ***1–2 marks***	• *A response with minimal knowledge and understanding of the relevant ITGS issues and concepts.* • *A response that includes minimal use of appropriate ITGS terminology.* • *A response that has no evidence of judgments, conclusions or future strategies.* • *The response may be no more than a list.*
Adequate ***3–4 marks***	• *A descriptive response with limited knowledge and/or understanding of the relevant ITGS issues and/or concepts.* • *A response that includes limited use of appropriate ITGS terminology.* • *A response that has evidence of conclusions, judgments or future strategies that are no more than unsubstantiated statements. The analysis underpinning them may also be partial or unbalanced.*
Competent ***5–6 marks***	• *A response with knowledge and understanding of the relevant ITGS issues and/or concepts.* • *A response that uses ITGS terminology appropriately in places.* • *A response that includes conclusions and/or judgments that have limited support and are underpinned by a balanced analysis.*
Proficient ***7–8 marks***	• *A response with a detailed knowledge and understanding of the relevant ITGS issues and/or concepts.* • *A response that uses ITGS terminology appropriately throughout.* • *A response that includes conclusions, judgments or future strategies that are well supported and underpinned by a balanced analysis.*